Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Laboratory for Energy Conversion

adlyte

High-Brightness LPP source for EUVL applications

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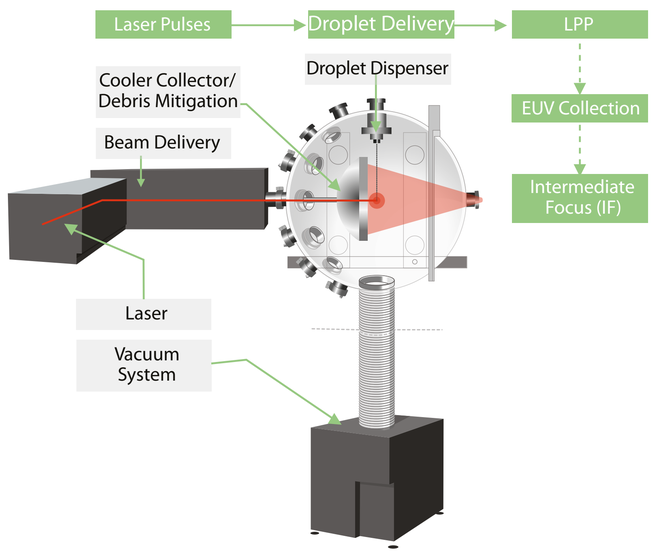
LEC/ETH Zurich and Adlyte have taken significant steps forward in developing high brightness EUV source products based on LPP technology with the distinct advantage of not only covering the requirements of mask metrology and inspection but also providing extendibility for multiple device nodes. For these applications the system has one main core combined with different optics to satisfy each individual application. The system can be scaled up to achieve high EUV power at the intermediate focus. The targets used to achieve the highest CE when irradiated with a high power Nd:YAG laser in the current system are high speed and frequency Tin droplets. To minimise debris being detrimental to the first collector optics, a unique debris mitigation technique has been developed.

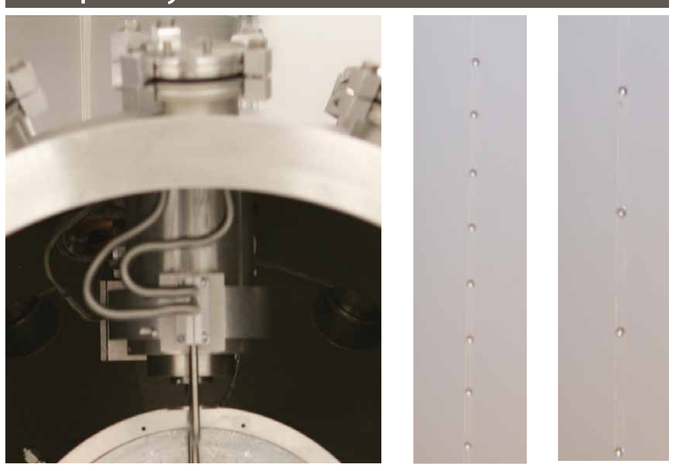
Technology Demonstration Stand

- High brightness which has been measured to is 259W/mm^{2}sr.
- Power at the source of 12W/2π.
- The source can operate at 90% duty cycle.
- Footprint as compact as 2.6m^2.
- State of the art mitigation system.

Source Layout



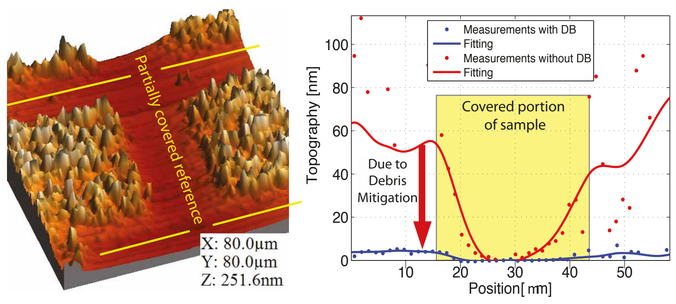
Droplet System



- Droplet size of 50 μm optimized for process.
- Operating repetition rate up to 60 kHz.
- Integrated droplet tracking and steering system.

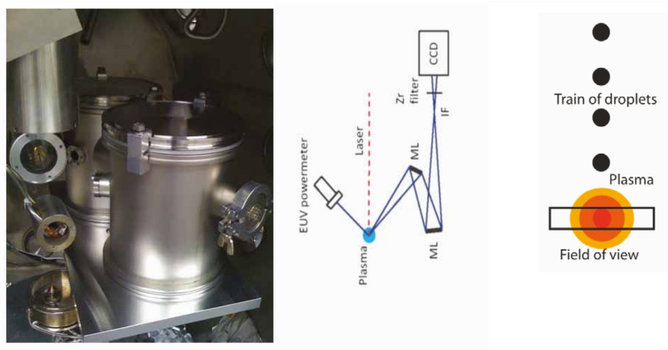
Collector Optic Assembly

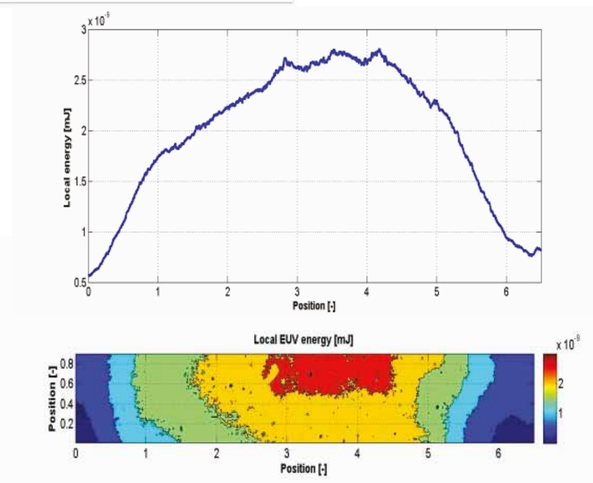
Debris Mitigation Results



- Left: AFM measurement sample without debris mitigation.
- Right: Comparison of samples with and without debris mitigation.

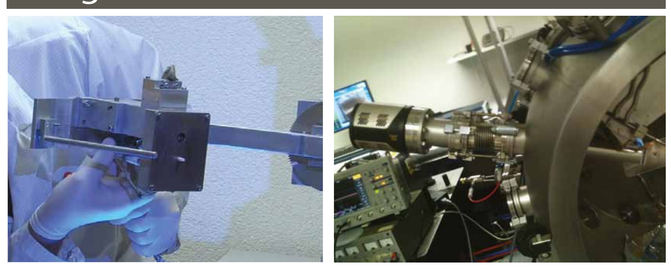
Intermediate Focus Measurements



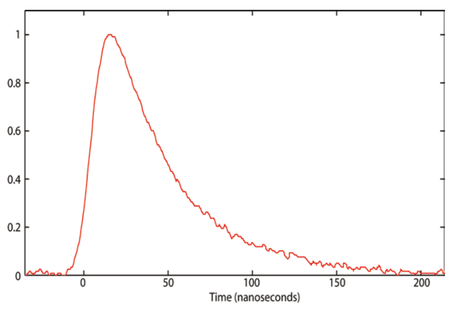


- CCD positioned at a distance from IF to maximize resolution of recorded EUV signals.
- EUV Power measurements at the IF are cross calibrated with E- Mon Measurements.

Diagnostics

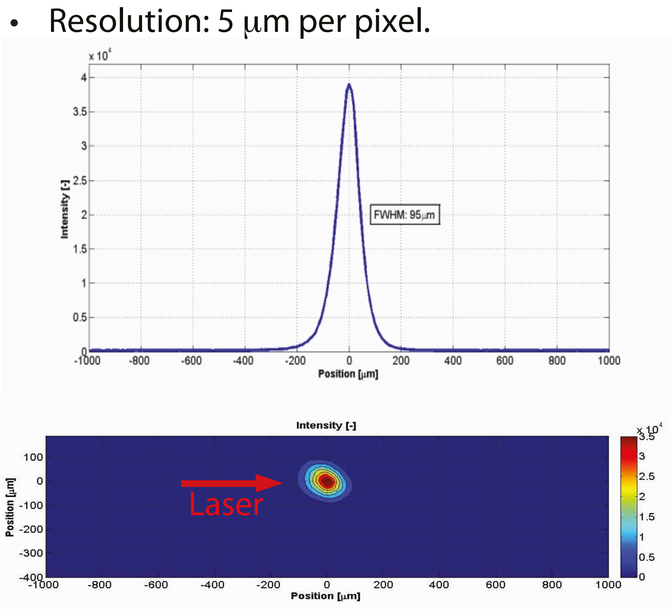


- EUV source power measured with a calibrated Scientec Energy Monitor.
- Consists of a Mo/Si mirror and a Zr filter calibrated at F.O.M. and N.I.S.T.



EUV source power.
C.E.:1.05%

- In-house developed pin-hole camera with a Zr filter and PIXIS CCD.
- Variable magnification up to x 5.
- Resolution: 5 μm per pixel.



- Viewing Angle 90 degrees with respect to the laser axis

Summary

Parameters	Measured
Laser power on target (W)	1100
Laser frequency (kHz)	6
Laser focal spot size (μm)	78
EUV source size (μm)	95
Average conversion efficiency (%)	1.05%
Source brightness (W/mm /sr)	≈259

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